

CYBERSONICS—TAPPING INTO TECHNOLOGY

Just this year, NASA successfully landed the NEAR (Near Earth Asteroid Rendezvous) spacecraft on the asteroid Eros as part of a space exploration project. As NASA space exploration expands, the need for revolutionary new technologies increases. A company from northwestern Pennsylvania has stepped up to the plate and delivered an innovative technology with infinite possibilities. Cybersonics, Inc., of Erie, Pennsylvania, with the assistance of **Small Business Innovation Research (SBIR)** funding from NASA's Jet Propulsion Laboratory (JPL), Pasadena, California, has developed an ultrasonic drill with applications ranging from the medical industry to space exploration.

The drill, which has the ability to take a core sample of the hardest granite or perform the most delicate diagnostic

medical procedure, is a lightweight, ultrasonic device made to fit in the palm of the hand. Piezoelectric actuators, which have only two moving parts and no gears or motors, drive the components of the device, enabling it to operate in a wide range of temperatures. Piezoelectricity is the generation of electricity in dielectric crystals (crystals that do not conduct electricity) subjected to mechanical stress.

There are three main sections to the drill: an ultrasonic actuator, a free-mass resonator, and a drill stem. The device operates when vibrations from the ultrasonic actuator excite the free-mass resonator. Acoustic energy in the resonator is transferred to the drill stem and then to the surface of the interface, where the interface is excited past its ultimate strain, and fractures.

The most remarkable aspect of the drill is its ability to penetrate even the hardest rock, such as basalt, with minimal force application. The ultrasonic device requires 20 to 30 times less force than standard rotating drills, allowing it to be safely guided by hand during operation. This is an important feature when attempting to drill a core sample in zero gravity, where an astronaut's positioning to the interface is not always optimal. Also, the drill is operable at a level as low as three watts of power, where conventional drills require more than three times this level.



Requiring 20 to 30 times less force than standard rotating drills, Cybersonics' ultrasonic drill has the ability to penetrate even the hardest rock, with minimal force application.